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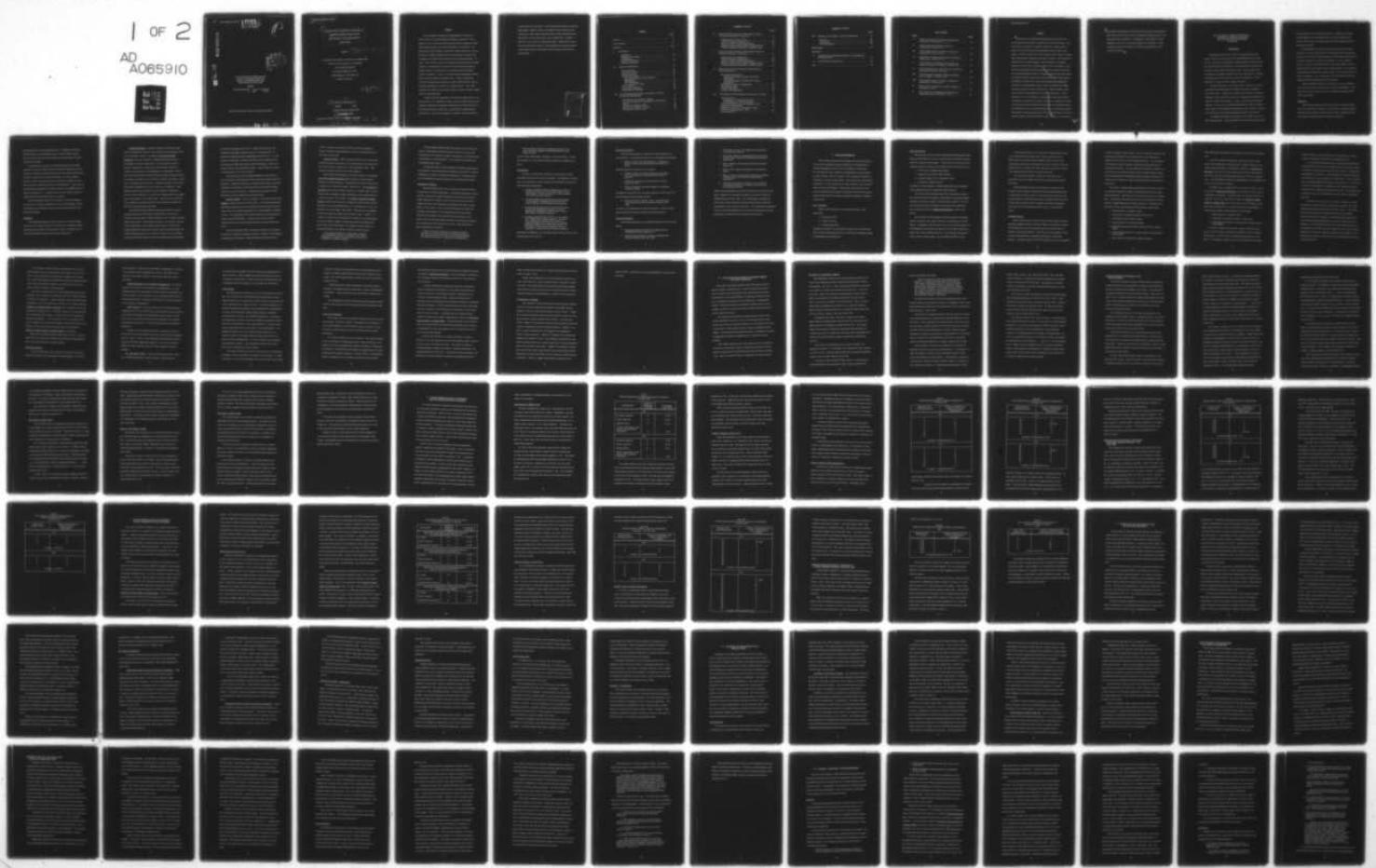
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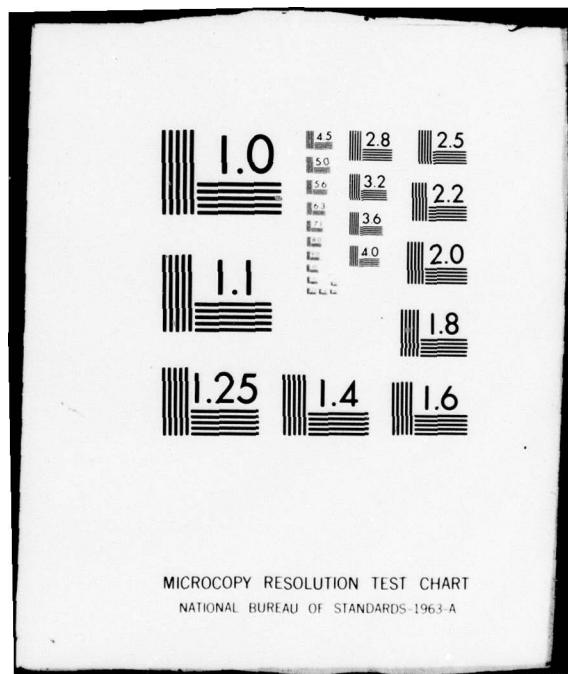
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AN ANALYSIS OF TRENDS IN THE
USE OF A MASTER'S THESIS IN
GRADUATE ENGINEERING AND
MANAGEMENT PROGRAMS

THESIS

AFIT/GSM/SM-78S James L. Simmons
-20 Capt USAF

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AN ANALYSIS OF TRENDS IN THE USE OF
A MASTER'S THESIS IN GRADUATE
ENGINEERING AND MANAGEMENT
PROGRAMS.

THESES

9 Master's thesis

Presented to the Faculty of the School of Engineering
of the Air Force Institute of Technology
Air Training Command
in Partial Fulfillment of the
Requirements for the Degree of
Master of Science

12 110P

by

10 James L. Simmons / B.S.

Captain USAF

Graduate Systems Management

11 September 1978

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Preface

Strong opinions involving the requirement for the master's thesis seem to be voiced whenever the topic is discussed. There appears to be no neutral ground between those who support the thesis requirement and those who see little benefit in such efforts. Certainly many thesis students, and possibly faculty advisors as well, at one time or another question the value of the master's thesis when compared to the high costs involved in terms of time and effort. In spite of this, there is no source available that satisfactorily describes whether or not the thesis is merely a relic from the early days of graduate study, or if the thesis is an integral part of all quality master's programs. In fact, very little current information concerning the master's thesis is available at all. Before starting this research I questioned the purpose for doing a thesis and the value of the thesis experience in terms of the required effort. This study seemed to be a timely one because I found very little consensus among others on these questions.

I want to take this opportunity to express my appreciation to my thesis advisor, Dr. Raymond H. Klug, for the invaluable help and contributions which have contributed immeasurably to this thesis and to the growth experience which I have received from completing this thesis effort. I also want to thank Dr. Joseph P. Cain who acted as

second reader for this thesis. His cooperation and ideas are greatly appreciated. Similar thanks are extended to those educators who freely gave of their time during interviews to share their ideas and experiences to make this study a more complete one. Finally, I thank Ms. Joyce Clark who typed this thesis. Without her cooperation and professional approach, the preparation of this thesis manuscript within the time constraints of this program would not have been possible.

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Abstract

Today there is considerable disagreement about what educational experiences should be required for the master's degree. This research was conducted to examine trends in the requirement for thesis work in engineering and management master's degree programs. Trends in other areas such as thesis credit, master's degree total requirements, minimum grade point averages, requirements for proficiency in a foreign language, and time limits to completing master's work were also examined. Since 1970, the number of institutions with mandatory theses programs has decreased in both engineering and management master's degree programs while the number with optional theses programs has increased. Engineering programs have higher average thesis credit requirements than management programs, but management master's degree programs have higher average total degree credit requirements. Another portion of this study involved an examination of non-thesis alternatives. These alternatives can be classified as programs that delete the research requirement, programs that conduct research on a smaller scale than the thesis with requirements like term papers or independent studies, and alternatives such as internship programs or group design studies that provide a research experience of the relatively same scale as the master's thesis, but with a different format. Finally, a review and

examination regarding the current personal advantages and disadvantages of the master's thesis was accomplished through interviews with selected groups of educators. Advantages for the student, faculty, institution, and users of research findings were identified. Disadvantages cited involved high cost for faculty and student time and research facilities.

AN ANALYSIS OF TRENDS IN THE USE OF
A MASTER'S THESIS IN GRADUATE
ENGINEERING AND MANAGEMENT
PROGRAMS

I. Introduction

During the period of 1977-1978 it is estimated that 300,000 master's degrees will be earned in the United States (Ref 2:74, 224; 18:115). The resources expended for these degrees in terms of faculties, administrators, professional, and student efforts represent an enormous outlay of public and private funds. Even in light of this commitment to graduate education, there are indications of confusion regarding exactly what the master's degree represents, or should represent, in terms of goals, content, and focus.

Graduate education, in the present sense of the word, has been conducted in the United States for slightly more than one hundred years (Ref 15:429). During the formulation and evolution of graduate education in this country there has been a continuing evaluation of the objectives of graduate programs. Today, reassessment and change continue. Factors such as student dissatisfaction, state and federal funds cutbacks, and changing enrollments in areas of higher education are relevant factors for present graduate programs (Ref 14:491).

It is apparent that there is presently no one "right" way to conduct graduate study. Various methods have been introduced that offer

new alternatives in the educational process. Extended universities, external degrees, non-traditional study, and universities without walls are only a part of the terminology that is developing with these changes (Ref 14:484).

An examination of master's programs indicates that a single standard is no more existent today for this degree than during earlier portions of the history of graduate study when the number and diversity of master's degrees was much more limited. In such a situation, however, trends in a given field may be much more helpful in evaluating a specific program than would be rigid standards. This research was initiated and conducted to examine trends in one possible aspect of master's programs, i.e., trends in the use of the master's thesis in engineering and management master's programs.

Before meaningful study can be conducted, various definitions are necessary to insure conciseness in research and findings. Pertinent terms for this research effort are discussed and defined in the section that follows.

Definitions

Even though the purpose of this research is to examine trends in the use of the master's thesis, it is necessary to examine graduate education and the master's degree itself in order to examine the use of the graduate degree thesis in the proper perspective.

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Definitions

Even though the purpose of this research is to examine trends in the use of the master's thesis, it is necessary to examine graduate education and the master's degree itself in order to examine the use of the graduate degree thesis in the proper perspective.

Graduate Education. Graduate education evolved from other forms of education in much the same manner that the meaning for the word "education" evolved. According to The Oxford English Dictionary, the word "education" originally meant the process of nourishing or rearing a small child. The concept later came to include "bringing up" a young person with reference to place in society, social manners, and preparation for employment. After a time, education assumed a formal meaning usually associated with the word today--the entire course of formal scholastic instruction, schooling, or training a person receives. Graduate education more closely fits the final definition that is given to the word "education." This definition states that education is the development of intellectual powers or the formulation of a character of thought rather than imparting mere knowledge or skill (Ref 20:44). Other factors are involved with a definition of graduate education that adequately includes the diversity of graduate programs today.

The theme that differentiates graduate education from undergraduate education is based upon concepts which come from two German terms that mean "freedom of inquiry" and "freedom of investigation" (Ref 10:437). Early graduate programs in Germany, and later in the United States, were founded on these ideals. Not only was graduate education conducted to preserve and transmit knowledge and provide education necessary for specific careers, such as teaching, but this type of study became involved with advancing the leading edge

of a field of knowledge (Ref 27:4-5). In light of this history, the orientation of graduate programs must, to varying degrees, be research oriented and involve independent work (Ref 27:1). For the purposes of this paper, graduate education will be defined as post-baccalaureate studies that include advanced training in a field, and include research and independent studies. These studies can lead to an earned master's or doctoral degree.

The areas given in the preceding definition are the basis for most discussions concerning the scope and purpose among respective programs. Significant differences in opinion and practice arise when attempting to determine to what extent each area should be emphasized for the master's degree. Findings and conclusions in these differences are developed in this study and report.

Master's Degree. The word "master" is derived from the Latin magister, which means teacher (Ref 29:63). The connection between teaching and graduate study was present because the main purpose of many of the early graduate programs was to train people for teaching careers. The importance of the master's degree in the teaching profession is still visible today. In recent years, more master's degrees have been awarded in education than in any other field (Ref 27:63).

In the United States today, the master's degree can be defined generally as a degree of advanced character, usually a second degree, ranking above the bachelor's degree and below the doctorate (Ref

12:169). Because of the large variety of master's programs, a further detailed working definition in terms of requirements is not necessary at this point.

Master's Thesis. While the master's thesis is not universally included in master's programs, it has historically been important in many and is still an integral part of some programs today. This research examines these areas in later chapters.

Several different definitions of the term "thesis" are available.

The Oxford English Dictionary defines thesis as a dissertation to maintain a stated proposition, "especially one written or delivered by a candidate for a University degree" (Ref 21:295). The Dictionary of Education describes the master's thesis as "a written report of some extensiveness submitted in partial fulfillment of the requirements for a master's degree" (Ref 12:608). The Guide to American Graduate Schools summarized the general meaning of the thesis in the master's programs in the United States today as a "comprehensive survey of a specific area of knowledge" (Ref 16:xxi). This same source expands on this description by stating that terms like "essay," "paper," or "report" are used in various programs to imply a more limited paper in terms of length or depth of content that would be included in the term "thesis" (Ref 16:xxi-xxii). For purposes of this research, a combined definition of the master's thesis is used as follows:

The master's thesis is a written report resulting from an extensive survey of a specific area, that is submitted in a specific formal format, in partial fulfillment for a master's degree.

The preceding definition differs from the one for the doctoral thesis or dissertation in that the master's thesis is a survey and normally does not require an original contribution to the advancement of knowledge in a given discipline, as is required of most doctoral dissertations (Ref 16:xxi).

The general nature of these definitions provides an appropriate introduction for the problem that is examined in this thesis. General definitions are subject to varying interpretations, a situation presently exemplified by master's programs in the United States today.

Statement of Problem

The sheer number and variety of master's programs indicate change that is currently taking place. An apparent ambiguity concerning what constitutes acceptable standards for the master's degree is another indication of change. Some of the factors involved in this change date back to the beginnings of graduate study in this country. Others are the result of very recent developments that impact the educational environment. Even though professors and students annually work millions of man-hours on thesis programs, there seems to be very little information available concerning the comparative requirements and the value of such work. The problem this thesis addresses is as follows:

There is a need for research to determine current practices in the use of the thesis in master's programs, the credit earned for such work, and non-thesis alternatives that are available, or innovative substitutions to

thesis programs which are presently being used, such as the Air Force Institute of Technology (AFIT) group design program.

In the context of this study, the phrase, "use of the thesis," means the inclusion of, or the requirement for a thesis in a graduate program.

Assumptions

In order to conduct this research, it is necessary to make assumptions about the area that is examined. The approach, development, and conclusions of this research are developed on the basis of these following assumptions:

1. Because change has been an integral part of the one hundred year history of the master's degree in the United States, no final standards for such programs will come from this research.
2. Valuable insights into present and future programs can be gained by studying historical trends and factors that have and will affect these programs.
3. Even though this research is concentrated on engineering and management programs, the basic approaches and findings could be used to analyze other types of master's programs.
4. Graduate programs such as AFIT, do not significantly differ from civilian programs. Because of this, trends and conclusions from studies of civilian programs will be applicable for graduate programs conducted for and by the military. In like manner, such graduate programs can lend valid data to studies involving civilian institutions.

Using these assumptions, the following research objectives have been established for this research.

Research Objectives

Research for this paper is conducted to fulfill objectives on several levels. The primary objective is to accomplish the following:

1. Identify trends in the requirement for completing a thesis in management and engineering master's programs.

Secondary research objectives are as follows:

2. Identify trends in non-thesis alternatives presently in use in management and engineering master's programs.
3. Identify possible thesis alternatives that could be used in the future.
4. Identify advantages and disadvantages of completing a master's thesis.

In addition to the primary and secondary objectives, this writer has the following personal learning objective:

5. Increase personal insights, skills, and appreciation of the research process during the conduct of this study.

In order to accomplish these research objectives, a series of questions have been formulated to guide the research activity.

Research Questions

The following questions are considered during research for this thesis:

1. How many master's programs in engineering and management require thesis work?
2. Has the present number of programs changed from similar programs eight years ago?

3. What trends, if any, are evident from the answers to questions one and two?
4. What other changes in requirements have occurred in these types of master's programs during the last eight years?
5. What variations exist in thesis programs presently being used?
6. What are the available alternatives to the master's thesis?
7. What are some of the apparent advantages and disadvantages among various thesis and non-thesis alternatives?
8. What factors internal and external to the academic community exist that are relevant to the future use of the master's thesis?

These research questions conclude the introductory material for this study. Chapter II of this paper presents an overview of research methodology used in this study. This methodology is designed to answer the research questions listed previously and to satisfy the requirements of the research objectives. The methodology also identifies the scope and limitations to this study and describes the various phases that constitute the research effort for this study.

II. Research Methodology

This research was performed during a two quarter period as a portion of the academic program conducted by the Department of Systems Management of the Air Force Institute of Technology.

Dr. Raymond H. Klug, Professor of Management, was the advisor for this research, and Dr. Joseph P. Cain, Assistant Professor of Economics, was the second reader. The research was conducted in three parts. (1) Data Collection, (2) Data Analysis, and (3) Presentation of Research Findings. Collectively, these portions of the research methodology provided a framework to answer the research questions and satisfy the research objectives presented in Chapter I of this thesis.

Data Collection

Data for this research were collected using three main approaches:

1. Literature review.
2. Program reviews.
3. Personal interviews.

Using these methods, it was possible to gather data concerning the past, present, and possible course for the future of graduate studies in engineering and management.

Literature Review

The literature review for this research provided background and historical information as well as current factors involving the requirements for a master's thesis today. This review of the literature was conducted using four libraries in the Dayton area as primary sources:

1. AFIT School of Engineering Library
2. Wright State University (WSU) Library
3. Personal library of Dr. Raymond H. Klug
4. University of Dayton Library

In addition to these libraries, reference material from the Defense Documentation Center was reviewed for this research.

The AFIT School of Engineering Library provided a large portion of the historical and background information concerning graduate education, the master's degree, and the master's thesis. The 1970 and the 1978 program descriptions from a total of 366 institutions were reviewed in issues of Engineering Education located in this library.

The majority of the remaining current information concerning master's programs and master's theses was obtained from the WSU library. In addition to this material, the current college catalogs for 202 institutions and program descriptions for 339 other business programs from several different sources, as described in the program review section of this chapter, were located in the WSU Library.

The personal library of Dr. Raymond H. Klug provided numerous current periodical articles from a wide variety of sources.

These articles provided valuable insights for this research from newsletters and journals of education, as well as a series of articles gathered since 1970 which have been collected in conjunction with the long standing interest held by Dr. Klug in this area.

The University of Dayton Library was used when source materials were not available from other local libraries previously described.

The bibliography reflects the breadth and variety of source material used in addition to program and catalog presentations used to collect data for this research. The reviews of program and catalog descriptions provided data necessary to identify trends in the use of the master's thesis as well as insights into master's programs today that were not found during other portions of the literature review.

Program Reviews

Much of the literature review involved a wide scope of material including graduate education, master's degrees, and master's theses, but the program review was directed toward two specific types of master's programs and theses. The first part of the program review involved an examination of institutions which grant engineering degrees. Programs from the 1977-1978 academic year were examined.

In order to identify current trends, 1970 was arbitrarily selected, and programs from that year were examined to provide insights into changes that may have occurred during this decade. The second part of the program review involved a similar and comparable study of management programs. Not only did this provide data to analyze current trends in two separate fields of study, but these similar studies allowed engineering and management master's degree programs to be compared and contrasted to better understand the use of the master's thesis today.

The review of engineering programs began with research based on information published annually by the American Society for Engineering Education. The February 1970 issue was used as the starting point. Information extracted from this research established various aspects of engineering master's degree programs. Information was gathered, treated, and presented in the following classifications:

1. Requirement for a master's thesis.
2. Credit hours awarded for master's thesis work.
3. Alternatives to the master's thesis.
4. Requirements for a foreign language.
5. Minimum grade point average required to earn a master's degree.
6. Total minimum number of credits needed to satisfy degree requirements.
7. Time limit for completing the degree program.

This information represented current data for the 1969-1970 academic year.

In order to establish information concerning trends in these areas, and to determine current practices, another review was conducted using information from the March 1978 issue of Engineering Education. The 1978 review included the same seven areas listed for the 1970 review and represented information for 1977-1978 academic year. Only institutions located in the United States were included in the review of the 1970 and 1978 issues.

No single source containing 1970 and current year data, such as was located in Engineering Education, was available for the review of management programs. Because of this, two parallel studies were conducted. First, the 1969 and 1977 editions of Peterson's Annual Guides to Graduate Study (as of this writing, the 1977 edition was the latest guide available) were reviewed for program requirements in business and business administration for the following:

1. Requirement for a master's thesis.
2. Credit hours awarded for master's thesis work.
3. Total minimum number of credits needed to satisfy degree requirements.

In order to expand the scope of the study of management programs so that it would be commensurate with the review of engineering programs, a second review of management programs was conducted. Even though a single source was not available that included

1970 and 1978 data, this study had more current data for a larger number of institutions than the first management review.

A current membership directory for the American Assembly of Collegiate Schools of Business (AACSB) was used to provide a listing of programs that would be of interest in this research. Nonacademic organizations or businesses, and universities in countries other than the United States were excluded from consideration. The first school in the remaining alphabetical listing was selected and the current catalog from that institution was obtained from the reference catalogs maintained at the Wright State University Library. The catalogs were reviewed for the seven classifications of data listed for engineering programs.

The intent of this review was to examine a number of current management programs which was similar to the number of current engineering programs that had been reviewed earlier. This meant that less than half of the remaining institutions in the AACSB directory needed to be reviewed. A preliminary investigation indicated that the required published data were not available for every institution. It was decided to select every other institution from the remaining list and if data were not available for that school, the next institution on the list was selected and the process continued. This methodology resulted in a total of 202 of the 540 institutions from the list being reviewed.

The catalogs reviewed contained announcements for the 1977-1978 academic year even though some were dated as early as 1975-1976. In these instances, the school had a multiple-year catalog. The required information was obtained from general, graduate school, and/or school of business catalogs, as required for master's programs offered in business and management.

Once the current year data for the management programs were gathered, it was necessary to obtain data from 1970 to allow analysis of trends to be conducted. College catalogs for the institutions listed in Appendix A were not available for 1970 data, but a listing, entitled Programs of Graduate Study in Business, was compiled in 1970 by the Educational Testing Service. Programs reviewed in current catalogs were referenced in this listing. A listing of these 1970 programs is attached in Appendix A. The summaries of the 1970 programs were not as complete as the catalog descriptions, but the same three classifications of data as previously collected from the summaries in Peterson's Annual Guides to Graduate Study were gathered.

After data were gathered from the preceding sources, a series of interviews were conducted to determine the advantages and disadvantages of the requirement for a master's thesis.

Personal Interviews

A series of interviews was conducted to provide current information and opinions on the advantages and disadvantages of a master's

thesis program. Members of the Academy of Management, educators from the AFIT School of Engineering, and Dr. Raymond H. Klug, advisor for this thesis research, were all interviewed as a part of this study.

Selected Members of the Academy of Management. During the August 1978 conference of the Academy of Management, Dr. Klug conducted interviews concerning the master's thesis requirement with several members of the Academy, who are all respected educators in the management field. Included in this group were six past presidents of the Academy of Management.

AFIT Educators. A group of professors from engineering and management areas at the AFIT School of Engineering were interviewed concerning the advantages and disadvantages of the master's thesis. Each of these professors has had extensive experience with students conducting thesis research. A list of these educators is included in Appendix B.

In addition to the preceding interviews, an interview was conducted with the Associate Dean for Research, AFIT School of Engineering, Dr. Lynn E. Wolaver, concerning the group design study that is used in the Systems Engineering program. Dr. Wolaver provided insights into this program and also into other aspects of master's research.

Dr. Raymond H. Klug. A series of discussions with Dr. Klug was conducted during this research activity. The discussions

provided numerous insights into the advantages and disadvantages of thesis research. These insights were especially helpful because of the extensive experience Dr. Klug has had with both engineering and management master's programs in six colleges and universities.

Data Analysis

The data that were collected as a part of the program review portion of this research for both engineering and management master's degree programs were analyzed in a similar manner except in the area of the requirement for a master's thesis. The summarized data collected for engineering programs were placed into four classifications, no thesis, thesis required, optional thesis program, and thesis requirement at the option of the individual department. The data for the management programs were more complete and required only the first three classifications. If the requirements for a program were unclear, that program was not included in any classification. If an institution offered two or more separate degree programs, for instance a Master's in Business Administration and a Master's of Science degree in Management, all of the programs were included in the appropriate category. Only institutions located in the United States were included in any of this analysis.

If a range of credit was offered for thesis work by an institution, the highest value was selected for inclusion in this analysis. In order to provide an accurate understanding of the value of thesis work, thesis

credit was selected as the stated thesis credit requirement or the number of credits required in lieu of thesis work, whichever was larger. All credit requirements for thesis work were converted to semester hours.

In determining total credit requirements for master's degree programs, the highest value was selected if a range of requirements was offered. These values were also converted to semester hour credits.

The remainder of the data collected during the program review portion of this research has been summarized and presented in table form.

Scope and Limitations

This research has been conducted to examine one facet of graduate education, the master's thesis. The purpose of the research is not to decide whether or not the master's thesis is "good" or "bad," but rather to study trends in the use of the thesis and non-thesis alternatives.

Two separate studies have been conducted. One study examined the use of the thesis in engineering master's degree programs. The number and variety of engineering programs available in colleges and universities in the United States precluded an examination of all engineering master's degree programs. Because of this, a representative number of institutions was selected by using those with program

descriptions presented in the American Society for Engineering Education journal, Engineering Education. The 1970 program content from 176 institutions and the 1978 program content from 190 institutions were reviewed.

A similar examination of program content was conducted for master's programs in management. Once again, the number and variety of programs in this field precluded an examination of all courses of study presently offered. Instead, institutions were selected from the membership of the American Assembly of Collegiate Schools of Business. A total of 202 institutions from the membership list were reviewed. The 1970 programs from eighty of these institutions were also reviewed. A parallel study was conducted using schools of business and business administration included in Peterson's Annual Guides to Graduate Study. During this portion of the research effort, the programs from 136 universities granting master's degree in management in 1969, and programs from 123 universities in 1977 were reviewed and analyzed.

Because this research was conducted during two academic quarters, it was also necessary to limit other portions of the research in areas such as the literature review. The volume of literature involving graduate education precluded a complete examination of all available materials in this area. In deference to time constraints, the literature review was limited to materials concerning the master's

thesis, except where historical or background requirements necessitated a broader review.

Similar time limitations were involved with the interview portions of this research. Only a sample number of educators could be contacted. Time limitations also precluded interviewing graduates from master's programs and the users of thesis research to further identify advantages and disadvantages of master's thesis programs.

Presentation of Findings

The remainder of this thesis presents the information obtained from the research methodology presented in this chapter and the analysis of the data collected during these research efforts. Chapter III of this thesis presents results from the literature review concerning the master's degree and the master's thesis. Following this review, Chapter IV presents the results from the program review and analysis of engineering master's degree programs. Chapter V contains a similar presentation for the findings from management master's degree programs. Chapter VI compares and contrasts the findings from Chapters IV and V, and contains a presentation of non-thesis alternatives that are currently being used in various institutions which were examined in this study. Chapter VII presents the results from personal interviews which describe various advantages and disadvantages associated with thesis work as viewed by a selected group of educators. Finally, Chapter VIII contains a summary of this

research effort, conclusions, and recommendations for future action and study.

III. The Background and Origin of the Master's Degree and Thesis Requirement

Discussions concerning graduate study, the master's degree, and the academic requirement for a master's thesis involve many factors present in the environment today: government involvement, society needs, fiscal considerations, increasingly complex technology, knowledge increasing at an accelerating rate, and population trends. The present diversity in programs and the several sources calling for reform are not only a function of these modern pressures, but also historical factors.

The relatively short history of graduate study in this country readily establishes sources for many of the differences and causes for discussion that are presently witnessed. A brief historical review of the master's degree and the master's thesis is presented in this chapter. This historical examination provides a foundation for further development and analysis of findings that are discussed in later chapters.

This chapter approaches the topic sequence by first examining the history of the master's degree and then discussing the role the master's degree plays from both historical and present day perspectives. Then, the master's thesis is examined in a similar manner.

The History of the Master's Degree

The beginnings of what has evolved into graduate studies can be traced to the Athenian education system which produced the Library of Alexandria. By 30 B.C., this museum housed 700,000 volumes and was a center for scholars and research work (Ref 9:12). From this early start, higher level education continued until the first master's degree was awarded in the twelfth century from the University of Paris, in the form of a Master of Arts (Ref 27:63). This is a somewhat arbitrary beginning for the master's as a separate academic degree because at the time there was no distinction made between the terms for master, teacher, and doctor (Ref 6:178).

In England by the 1600s, the master's degree as an earned degree had been replaced with a master's that was only an honorary degree given by an institution to alumni (Ref 29:175). The requirements for this honorary degree have been described facetiously as "staying alive and out of trouble for three years after graduating from college and by giving modest evidence of intellectual attainments" (Ref 3:6).

The practice of awarding honorary master's degrees was exported to America. For example, Yale awarded this type of degree as early as 1702. It was not until 1878 that this institution awarded the master's as an "earned" degree (Ref 15:432).

As early as 1642, Harvard College offered a "second degree." The requirements for this program reflect certain similarities to

master's programs seen today:

Every Scholar that giveth up in writing a System or Synopsis, or summe of Logick, Naturall and Morall Phylosophy, Arithmetick, Geometry, and Astronomy: and is ready to defend his Theses or position: withall skilled in the originalls as abovesaid (the requirements for a bachelor's degree): and of godly life and conversation: and so approved by the Overseers and Master of the Colledge, and at any publique Act is fit to be dignified with his 2d Degree. (Ref 5:429)

By 1825, Harvard had reverted to the English custom of the honorary degree by declaring any alumni to be eligible for this second degree three years after the first, payment of a set fee, and "proof of good character." (Ref 15:431).

Early efforts in graduate education were also seen at Yale when the graduate program was separated from the undergraduate in 1814 (Ref 5:577). Other institutions were doing similar work in this area. The University of South Carolina in 1812 and the University of North Carolina in 1856 both awarded what was called a master's degree, although the academic requirements for these degrees were such that these universities are not considered to be the first to award the degree in the present definition of a master's degree (Ref 15:432).

Some evidence can be given that supports the University of Michigan as the first to award an earned master's. In December of 1858, the regents of this university established a Master of Arts degree and a Master of Science degree. Both programs required at least one year of study beyond the bachelor's degree, a minimum of two courses per semester, a comprehensive examination covering

three of these courses, and a thesis (Ref 27:64). This, like other earlier attempts, is usually discounted from qualifying as graduate work in the present sense of the word. The program could more closely be described as a powerful undergraduate program in scope and orientation (Ref 5:578).

Most authors credit Johns Hopkins University with establishing the first graduate program in 1876 (Ref 3:6; 5:578; 15:429). Clark University soon followed with a similar program in 1887, as did the University of Chicago in 1892 (Ref 15:429). By 1896 the one-year master's degree program had effectively replaced the three-year honorary master's degree (Ref 27:64).

In tracing the history of the master's degree, a distinction has been made between what is merely a continuation of an undergraduate program, or a classical and traditional-centered curriculum, and a graduate program that could be identified by "its professional character, its utilitarianism and community-centered program, its stress on advancing learning, its new subjects of study, its seminars and laboratories and dissertations . . . (Ref 3:16)." Even though the Ph.D. rapidly became the highest degree for this type of graduate study, an understanding of this approach to graduate education which began in this country in the 1870s is important to the examination of the master's degree and the master's thesis.

Factors Affecting the Development of the
Master's Degree

The German tradition of higher education that was adopted by graduate schools in the United States is centered around the idea of freedom of inquiry and investigation (Ref 15:427). This represents an important distinction from the English tradition: rather than continue a broad, primarily liberal arts undergraduate approach to education, the programs established in the latter part of the nineteenth century represented an introduction to specialized courses and research in depth (Ref 29:89).

This tradition dates back to the early German states at the beginning of the nineteenth century. During this period, it was advocated that true learning involved the self-discovery of the mind and not the rigid approach which had traditionally been used in education conducted by the Church or state (Ref 24:150).

This German influence in the new graduate programs in the United States can be explained by noting that many of the educators involved in the new programs had studied abroad, mainly in German universities. Folwell at the University of Minnesota, Gilman at Johns Hopkins University, and Eliot of Harvard University are examples of such educators (Ref 15:429).

By 1900, the German influence had to a great extent become dominant (Ref 15:438). Some discussions concerning various aspects of graduate education, such as the nature and content of the master's

degree, had just begun, however. An attempt to establish standards for graduate work began in 1900 when the Association of American Universities (AAU) was formed (Ref 15:433). The debate concerning what the master's degree represented had begun by 1902 when the AAU tried to decide if this was a terminal degree or a step on the way to a doctoral degree. In 1910, Calvin Thomas of Columbia described the master's degree to the AAU as "slightly a cultural degree, partly a research degree, but everywhere a teaching degree . . . (Ref 3:185)." A terminal degree is one that is the highest degree obtainable in an academic institutional sense; in a personal sense it is the highest degree a person plans to receive. Such a degree is often earned to satisfy employment and career progression requirements in a specific career area.

In an attempt to bring order to the situation, the AAU adopted a set of standards for the Master of Arts degree in 1915 that required at least one year of graduate study and residence. Despite these early attempts at standardization, the AAU noted in 1932 that there was justifiable dissatisfaction with the status of the master's degree, and that "the immediate standardization of requirements is impractical in view of the several useful purposes which the degree now serves in different institutions (Ref 15:436)." These findings were echoed in the 1934 John report from the Office of Education that suggested the place of the master's degree "doubtless never will be answered finally (Ref 3:185)." The question still remains and further

substantiates the need for this research effort.

In 1945 another examination of the master's degree was conducted by the AAU. The findings concluded that too often the master's included merely a continuation of an undergraduate education with emphasis on the accumulation of facts. The AAU recommended at that time that the M.A. and M.S. be designated as research degrees. Technical subjects should be identified by the M.A. or M.S. and have a professional modifier assigned, such as a Master of Arts in Education. It was also recommended that the master's degree requirements include at least one year of residence, a comprehensive examination at the completion of work, an essay or thesis, and a language requirement (Ref 3:69).

In a report for the Association of Graduate Schools in 1959, Elder recommended that the master's degree should not be an intermediate step toward the doctorate or a "consolation prize" to those who failed to attain a doctorate. The same report encouraged a program for the master's degree that lasted at least fifteen months. The first year would be used to study a subject and become familiar with research methods. The remainder of the program would involve a seminar, college teaching, and an essay (Ref 3:70).

More recently, the Council of Graduate Schools adopted a statement that included desirable standards for the master's program. These included at least one year of graduate study, a "coherent sequence of lectures, seminars, discussions, and independent studies

or investigations designed to help the student acquire an introduction to the mastery of knowledge, creative scholarship, and research in his field." The report concluded that quality programs will usually have comprehensive examinations covering studies (Ref 3:70).

Even with such a specific set of standards available as those adopted by the Council of Graduate Schools, there is no indication that these are coming into general use.

The Master's Degree Today

The continuous efforts to standardize the master's degree over the last eighty years tend to indicate that all efforts to bring conformity to the field were not all successful. Today there remains a variety of answers to the question of what the master's degree represents and what requirements are necessary for the degree.

One of the more descriptive, albeit somewhat unscholarly definitions of the master's degree, was voiced by J. P. Elder when he described the master's degree as "a bit like a streetwalker--all things to all men (and at different prices) (Ref 3:185)." Howard Mumford Jones offered another description when he said the master's started "as a social distinction, became a postgraduate degree, . . . and is today a consolation prize, an insurance policy, or a sop to public education (Ref 3:20)."

In 1960, there were 150 types of master's degrees offered by various schools in the United States (Ref 4:46). Presently, there are

more than 500 types of master's degrees being offered (Ref 10:1760-1770). Approximately 260,000 master's degrees were earned in 1972-1973 and this number is projected to increased to 300,000 by 1977-1978 (Ref 2:74, 224; 19:115). The residence requirements for these degrees range from as little as sixteen weeks to two or more years. Approximately one fifth of these programs require no comprehensive examinations. About thirty percent require a thesis and comprehensive examinations; the remaining programs require only one or the other (Ref 29:88).

History of the Master's Thesis

Historically, the thesis has been a written dissertation to examine a stated position by a candidate for a university degree (Ref 21:295). In the first decade of the eighteenth century, Harvard used the term "thesis" to describe student compositions that confirmed or refuted some philosophical, scientific, or mathematical proposition (Ref 15:429).

The master's thesis was often a part of the new graduate programs in the latter portion of the 1800s. More recent examinations of the requirements for a master's thesis and the content of such theses have been conducted by the AAU. In 1935, the AAU stated that a master's program should include a thesis. It was also noted, however, that the thesis could represent a research, expository, or creative effort (Ref 3:18).

In 1945, the AAU again supported the inclusion of the thesis in the master's program, but by 1959, a report for the Association of Graduate Schools stated that a master's essay should be included instead of a thesis. The essay should show a knowledge of the subject, but not a claim to original work in the field of study (Ref 3:69-70).

The Master's Thesis Today

The original purpose of the thesis is closely tied to the idea of independent research in the graduate program. The objective of the thesis was to examine an area of knowledge by designing a system to collect relevant information, research the information, and analyze and present the results from this work (Ref 28:11). It differs from the doctoral dissertation by virtue of being a survey instead of an original work (Ref 16:xxi).

Today, the thesis can represent a research effort, a creative project, a recital, or an exhibit of art works or musical composition. It may also represent an essay or an essay-length report instead of a thesis (Ref 16:xxii).

The costs and benefits of a thesis in a specific master's program involve several considerations. First, the objectives of the graduate program and the part a thesis performs in support of those purposes must be examined. Second, what does a thesis cost in terms of faculty and student efforts? Next, does the thesis have relevance in preparing the student for endeavors he or she plans to undertake after receiving the degree? Possible alternatives to the thesis

that presently exist, or those that could be developed for future use should also be examined. Finally, what external pressures are being exerted on a master's program for change? Should these factors be considered, or are these pressures being directed at a program that was not developed or is not suited to perform these requested functions?

The number and complexity of these questions implies that an answer to the future of the thesis in the master's degree will not be a simple one. This thesis was initiated under the direction of Dr. Klug to try to develop better answers to some of these questions.

Chapters IV and V of this thesis present research findings that are both direct results from the historical factors presented in this chapter, and insights into future developments concerning the master's degree and master's thesis.

IV. Current Trends in the Use of the Master's Thesis in Engineering Master's Programs

Very little material is available in the literature that discusses to what extent the master's thesis is currently being used in engineering master's programs. There is also a scarcity of information concerning recent trends in this area. Interviewing faculty and administrators of graduate programs also proves to be less than satisfactory in many instances. The range of responses include the position that all "quality" master's programs must include a master's thesis to the other extreme that holds that none of the "good" engineering programs uses a master's thesis anymore. This research has found that neither of these extremes is in fact accurate.

Several areas of research findings concerning engineering master's degrees are presented in this chapter. First, an examination of the current use of the master's thesis and changes that have occurred in this area since 1970 is presented. Next, a comparison of changes in credit requirements for thesis work during the same time period is presented. In order to place this comparison in perspective with the program requirements for the master's degree, an analysis of total credits necessary for program completion in 1970 and 1978 is presented. The remaining portion of this chapter further examines trends that have developed in minimum grade point requirements, requirements for a proficiency in a foreign language, and time

limits established for completing program requirements once the master's work begins.

Requirement for Thesis Work

Several classification methods were examined before the four categories used in this section were chosen. Institutions in the data presented here are categorized as having (1) no thesis required, (2) a thesis requirement at the option of the individual department, (3) an optional thesis program, or (4) a thesis required. Although some information value is lost whenever data are summarized beyond the raw form, these four categories present a clear picture of the present use of the master's thesis in engineering programs and current trends in this area. Table I shows the 1970 and 1978 thesis requirements in engineering programs.

In 1970, 8.9% of the institutions reported that no thesis was required for the various master's degrees offered in engineering. By 1978, this percentage has decreased slightly to 7.8%. The number of institutions that allow the individual department to decide on the inclusion, exclusion, or optional use of the thesis also decreased slightly since 1970. In 1970, 8.4% of the institutions used this policy, but by 1978, this percentage has decreased to 7.8%. The remaining two classifications of thesis usage show larger changes than either of these first two.

Table I
Thesis Requirements in Engineering Master's Programs
1970 and 1978

Requirement	Number of Institutions in Sample	Percentage of the Total
1970		
No thesis required.	16	8.9%
Thesis required.	73	40.8%
Optional thesis.	75	41.9%
Thesis requirement at the option of the individual department.	15	8.4%
1978		
No thesis required.	15	7.8%
Thesis required.	49	25.4%
Optional thesis.	114	59.1%
Thesis requirement at the option of the individual department.	15	7.8%

The largest change in the thesis requirement between 1970 and 1978 occurred in the area of the optional thesis program. Almost 42% of the programs offered at 190 institutions in 1970 had various options, at least one of which included a thesis. By 1978, this percentage has increased to 59.1%. The largest portion of this change came from a reduction in the number of institutions that had mandatory thesis

programs in 1970. In that year, 40.8% of the institutions had required thesis programs. Eight years later, only about one quarter (25.4%) of the engineering programs require a thesis.

These changes show that the thesis is still a part of many, but not all, master's programs in engineering. Several other areas need to be examined before other conclusions can, or should be made from these findings. The following section provides part of this information by presenting current practices and recent trends in the credit awarded for thesis work.

Credit for Master's Thesis Work

Of the fifty institutions in 1970 that reported credit earned for thesis work, twenty-four, or almost half of the schools, awarded six semester hours of credit. The high in 1970 was sixteen semester hours, and the low was three semester hours of credit. The average for the year was 7.48 semester hours. This average decreased slightly to 7.33 semester hours in 1978, but the majority of the institutions (27 of the 57 reporting) still award six semester hours for thesis work. The range of credit hours remains the same as it was for the 1970 data.

In 1978, there were fourteen additional schools that did not explicitly report credit given for thesis work, but showed additional semester hour credit for non-thesis programs above the credit requirements for thesis programs. These programs were an average

of 3.43 semester hours higher than the thesis program at the same institution. Although the data are not adequate to precisely analyze and evaluate the impact this difference makes on the relative value of thesis programs, it is shown that the "semester hour" awarded for thesis work may not be equal and tend to be less than the "semester hour" awarded for course work, i.e., extra hours are required when extra courses are substituted for a thesis.

The data presented in Table II show that while the program requirements involving the thesis requirement have changed during the period 1970 to 1978, the actual amount of research effort required for a thesis, exemplified by the number of credit hours required, has remained stable.

Even though a small change has occurred in the absolute amount of thesis credit during the last eight years, an examination of total degree requirements shows that practically no change has taken place in the relative amount of thesis credit hours with respect to the total number of credit hours required for a master's degree.

Master's Degree Credit Requirements

In 1970 and in 1978, about two thirds of all engineering programs required a total of thirty semester hours of work to complete a master's degree (75% in 1970 and 61% in 1978). The lowest number of hours allowable for a master's degree was the same at twenty-four semester hours for the 1970 and 1978 data. The highest hourly

Table II
Credit Earned for Master's Theses in Engineering
1970 and 1978

Semester Hour Credit Requirement	Number of Institutions in Sample with Degree Requirement
1970	
3	2
4	1
5	4
6	24
7	1
8	2
9	3
10	5
12	7
16	1
Average: 7.48 Semester Hours	
1978	
3	3
4	4
5	1
6	27
8	3
9	10
10	2
11	1
12	6
16	1
Average: 7.33 Semester Hours	

requirement was thirty-six semester hours in 1970 and forty semester hours in 1978.

The data from this research, summarized in Table III, show an overall increase in the average number of semester hours

Table III
Credit Requirements for Master's Degrees in Engineering
1970 and 1978

Semester Hour Credit Requirement	Number of Institutions in Sample with Degree Requirement
1970	
24	2
27	4
30	111 (76%)
32	13
33	2
34	3
35	1
36	8
Average: 29.40 Semester Hours	
1978	
24	4
27	4
30	95 (61%)
32	18
33	14
34	3
35	1
36	16
40	1
Average: 31.06 Semester Hours	

required to qualify for a master's degree in an engineering field. In 1970, the average was 29.4 semester hours. This rose to 31.1 semester hours in 1978, or about a 6% increase above the 1970 figure. The 1970 thesis credit presented in the previous section represents 25% of the total average degree requirements for 1970,

while the 1978 thesis requirements represents 24% of the average program total for this year, and thus remains relatively constant as a substantial portion of the credit hour requirement.

Sometimes the presence or absence of a master's thesis is used as a quality standard to judge a particular master's program. The remaining portions of this chapter examine other areas that are sometimes viewed in a similar manner as quality standards, or as indications of the strength of a program. The first of these areas is the minimum grade point average that must be maintained to earn a master's degree.

Minimum Grade Point Average, Requirement
for Foreign Language Proficiency, and
Time Limit

Even though none of the three requirements described in this section have any direct connection with the master's thesis requirement, each area can also be adjusted to reflect changes in requirements, new internal or external pressures on the academic community, or a tightening or relaxing of standards. The first of these areas, the minimum grade point average (GPA) required for graduation, has not changed significantly since 1970, as shown in Table IV. Presently, the average of the minimum GPAs is 2.98 on a 4.0 scale. The percentage of institutions having a 3.0, or "B" requirement is 93%. The highest minimum GPA established for any of the institutions is also 3.0. A 2.5 is the lowest GPA presently being used. In comparison,

Table IV
Minimum GPA Required for Master's Degrees in Engineering
1970 and 1978

Minimum GPA (4.0 scale)	Number of Institutions in Sample with Degree Requirement
1970	
2.00	1
2.53	1
2.70	3
2.75	4
2.80	4
2.85	1
3.00	128 (91%)
Average Minimum GPA: 2.97	
1978	
2.50	1
2.53	1
2.70	1
2.75	2
2.80	2
2.85	3
3.00	129 (93%)
Average Minimum GPA: 2.98	

the 1970 minimum GPA average was 2.97, with 91% of the institutions reporting a minimum GPA of 3.0. Once again, none of the institutions had a minimum set above 3.0, although the lowest standard in 1970 was 2.0. If it can be assumed that there has not been inflation or deflation during this time period, an assumption that is not addressed in this research, standards involving grades have remained stable in

engineering programs. The same level of stability present in minimum GPA requirements is not evident in another area, the requirement for proficiency in a foreign language.

At one time in the late 1800s, the need to be proficient in a foreign language was common because graduate work had only been conducted outside the United States. At the doctoral level, the language requirement is still necessary in some fields to give assurance of ability to read related literature in that language for the conduct of research. In 1970, 7.6% of the engineering programs had departments which maintained requirements for proficiency. In 1978, 1.6% of the programs have this requirement.

One final area of the engineering master's programs was researched. This area was the maximum time limit established for completing all master's degree requirements. Table V displays 1970 and 1978 data concerning this requirement. Once again, this is an area that has remained stable during the time period examined in this research. In 1970, the average time limit was 5.4 calendar years, with the shortest being 3 years and the longest being 7 years. The 1978 time limits have the same range for the shortest and longest values, and an average of 5.5 years.

This chapter shows that the requirements for a master's degree in the field of engineering have not all remained constant during the last eight years. Chapter V shows that changes have also occurred in the requirements for the master's degree in the management field.

Table V
 Time Limit for Completing Requirements for
 Engineering Master's Degrees
 1970 and 1978

Time Limit (Calendar Years)	Number of Institutions in Sample with This Requirement
1970	
3	2
4	1
5	5
6	5
7	3
Average: 5.38 Years	
1978	
3	1
4	1
5	4
6	6
7	2
Average: 5.5 Years	

V. Current Trends in the Use of the Master's Thesis in Management Master's Programs

The areas addressed in Chapter IV for engineering master's programs and theses are examined for management programs in this chapter. Besides presenting information of interest in the area of management master's degrees and the use of the thesis, these data are used in later chapters to compare and contrast with trends that have been identified in engineering programs. This allows a more complete understanding of overall trends involving the use of the master's thesis than would be possible by examining these two areas in isolation.

The findings presented in this chapter were obtained from two parallel research efforts that are detailed in Chapter II of this thesis. Current information was collected about management programs from the general, graduate school, or school of business catalogs from 202 institutions. In order to observe trends in master's degree requirements, a similar review was conducted using eighty 1970 program summaries compiled by the Educational Testing Service (ETS). A second study was conducted using the 1969 and 1977 editions of Peterson's Annual Guides to Graduate Study. This review included 136 programs from 1969 and 123 programs from 1977.

Once again, as in the review of the engineering programs, trends in the use of the master's thesis are addressed first in this

chapter. The results from the 1969 and 1977 Peterson's guides and from the comparison of 1970 Educational Testing Service summaries with current college catalogs are presented. Next, semester hour credit given for thesis work is discussed, followed by a similar presentation of trends and current standards for total semester hours needed to satisfy minimum master's degree requirements. Finally, the research results that show current requirements for minimum grade point averages, foreign language requirements, and time limits established for program completion are presented.

Requirement for Thesis Work

Peterson's summaries of business and management programs in 1969 showed 56.6% of the institutions had no thesis requirement. Of the remaining institutions from the 136 that were examined, 25% had optional thesis programs, and 18.4% had required thesis programs. Similar statistics were compiled from the 1970 ETS summary of programs with 62.5% reporting no thesis requirement, 28.1% with an optional thesis program, and 9.4% with a mandatory thesis program. While these results are similar, the differences that exist between the two studies could have resulted from several sources. First, the programs that were reviewed were from different academic years, one in 1969 and one in 1970. Second, the groupings of institutions may be slightly different. Peterson's guides include institutions with programs that are classified as being business or management

programs by the Peterson organization. The ETS summaries were program descriptions from universities that required the Admission Test for Graduate Schools of Business (ATGSB) for student admission. Finally, Peterson's guides had only summarized categories of thesis, no thesis, or optional thesis and not complete descriptions of the program offerings. No criteria were listed, for example, to determine how an institution was categorized if the institution offered more than one degree in the business and management areas and the requirements differed between programs. In contrast, the ETS summaries included program descriptions from which data were classified as a part of this research effort. In spite of these differences, results from both the 1969 and 1970 summaries show the same relative ranking among the no thesis, required thesis, and optional thesis programs.

Results from both studies, presented in Table VI, show similar trends currently away from the mandatory thesis, but to an even greater extent, away from the "no thesis" programs to the optional thesis programs. In 1977, the summaries from Peterson's Annual Guides to Graduate Study show 13% with no thesis requirement, 8.9% with a required thesis program, and 78% with optional thesis programs. The survey of current college catalogs shows similar changes from the 1970 ETS compilation. In the current catalogs, 56.4% have no thesis requirement, 41% have optional thesis programs, and 2.6% have required thesis programs. The same reasons for differences

Table VI
 Thesis Requirements, 1969/1977 and 1970/1978
 in Management Master's Programs

Requirement	Number of Institutions in Sample	Percentage of the Total
<u>1969 Thesis Requirement in Management Master's Programs Summarized in Peterson's</u>		
No thesis.	77	56.6%
Thesis required.	25	18.4%
Optional thesis program.	34	25.0%
<u>1977 Thesis Requirement in Management Master's Programs Summarized in Peterson's</u>		
No thesis.	16	13.0%
Thesis required.	11	8.9%
Optional thesis program.	96	78.0%
<u>1970 Thesis Requirement in Management Master's Programs Summarized by the ETS</u>		
No thesis.	40	62.5%
Thesis required.	6	9.4%
Optional thesis program.	18	28.1%
<u>1978 Thesis Requirement in Management Master's Programs from Catalogs</u>		
No thesis.	88	56.4%
Thesis required.	4	2.6%
Optional thesis program.	64	41.0%

between the two studies that were cited for the previous data exist for the 1977 and 1978 results, except the criterion for selection in 1978 was membership in the AACSB instead of the 1970 criterion that the institution required the ATGSB for student selection. Although these differences exist, the direction of change is the same, away from a "no thesis" requirement and from mandatory thesis requirements to the optional thesis programs. Because the data from 1970 and 1978 are more complete and is taken from the same years used in the preceding engineering summaries, the 1970 and 1978 data from management master's programs are used in analysis in this study, rather than the 1969 and 1977 data.

Credit for Master's Thesis Work

The 1970 program summaries compiled by the ETS showed fourteen institutions that listed the number of credits that could be earned for thesis work. The average for the institutions was 5.43 semester hours, with 85% of the schools listing a 6.0 semester hour requirement. A survey of current college catalogs indicates an average of 6.36 semester hours awarded for thesis work. Once again, the largest number of institutions, thirty-eight of fifty-five, have a six semester hour thesis program. A review of current catalogs show extremes of three semester hours as the lowest amount of credit awarded and twelve semester hours as the highest, with the mode of six semester hours. The average requirement, as shown in Table VII,

increased, but it should be noted that the 1970 sample only includes fourteen institutions that reported requirements in this area.

Table VII
Credit Earned for Master's Theses in Management
Programs, 1970 and 1978

Semester Hour Credit Requirement	Number of Institutions with Degree Requirement in Sample
1970	
3	1
6	12
7	1
Average: 5.43 Semester Hours	
1978	
3	2
4	5
6	38
8	1
9	6
10	1
12	2
Average: 6.36 Semester Hours	

Master's Degree Credit Requirements

In order to evaluate the trends in credit earned for thesis work, it is necessary to understand what changes, if any, have occurred in the total program requirements during the period covered in this research. Results from this research are presented in Table VIII. The course summaries compiled in 1970 by the ETS showed an

Table VIII
Credit Requirements for Master's Degrees in Management
1970 and 1978

Semester Hour Credit Requirement	Number of Institutions with Degree Requirement in Sample
1970	
24	1
30	25 (42%)
31	1
32	5
33	7
34	1
35	2
36	11
39	1
40	2
43	1
45	1
48	1
54	1
Average: 33.42 Semester Hours	
1978	
24	1
27	2
30	52 (36%)
31	1
32	16
33	16
34	3
36	26
37	3
39	3
40	11
42	1
43	2
45	1
48	3
50	1
54	1
60	1
Average: 34.00 Semester Hours	

average minimum requirement of 33.4 semester hours necessary to qualify for the master's degree. The most common (42%) credit requirement was 30 semester hours. The lowest was 24 semester hours and the highest was 54 semester hours. The review of current catalogs showed the requirement minimum has increased slightly to an average of 34.0 semester hours. Once again, the most common requirement for current management programs is 30 semester hours (36% of all institutions). The range of program requirements is 24 to 60 semester hours. In summary, the average requirement as well as the mode for this data have remained stable during the period of this study.

Minimum Grade Point Average, Requirement for Foreign Language Proficiency, and Time Limit

As indicated in Chapter IV, the three areas presented here are sometimes viewed as standards for evaluating a specific master's program in much the same way the presence or absence of a master's thesis is used. This research does not support the strict use of these factors as quality standards, but changes in these requirements can be included when other trends that involve the master's thesis are analyzed.

Today, the minimum GPA necessary to qualify for a master's degree in the management programs reviewed is an average of 2.98 on a 4.0 scale. As shown in Table IX, a total of 93% of the institutions that were researched had a 3.0 GPA requirement. The range

of GPAs in the sample is 2.5 to 3.08.

Table IX
Minimum GPA Required for Master's Degree in Management
1978

Minimum GPA (4.0 Scale)	Number of Institutions with Degree Requirement in Sample
2.50	3
2.67	1
2.70	1
2.75	2
2.80	1
3.00	114 (93%)
3.08	1
Average Minimum GPA: 2.98	

An even less diverse response is evident concerning the requirement for proficiency in a foreign language. None of the programs that were reviewed required any foreign language proficiency for a master's degree.

The time limit established in which all master's degree requirements must be completed presently averages 5.86 years. A 6 year limit is used by 57% of the institutions in the sample. The shortest time limit is two years and the longest is eight years. None of these figures include special exemptions, such as additional time that may be granted when the student enters military service or other extenuating circumstances as merits special administrative or academic consideration. The time limits established by the institutions examined in this research are shown in Table X.

Table X
 Time Limit for Completing Requirements for
 Management Master's Degrees
 1978

Time Limit (Calendar Years)	Number of Institutions with This Requirement in Sample
2	1
3	1
4	2
5	26
6	58
7	10
8	6
Average: 5.86 Years	

This chapter presents the second half of the research findings of this study, those involving master's degree programs in management. In the next chapter, these findings are compared and contrasted with those from Chapter IV to examine trends in both areas, engineering and management, of the master's thesis and master's degree. Chapter VI also includes a review of a series of graduate program offerings that present alternatives to the master's thesis.

VI. Trends in the Use of the Master's Thesis and Non-Thesis Alternatives

The preceding two chapters provide individual presentations of changes that have occurred within the last decade in the master's thesis and the master's degree requirements for engineering programs and management programs. The purpose of this chapter is to analyze the trends that are evident in the two different areas and to compare and contrast the restrictive thesis requirement, and master's degree programs in these two areas. These discussions also include an examination of the non-thesis alternatives that are presently being used.

The first inference that can be drawn from the information presented in the two preceding chapters is that there is no one set of standards for master's degree programs. The Council of Graduate Schools in the United States concluded in a policy statement on the master's degree, that there are presently two major types of master's degrees. The first is an introduction to "scholarly activities and research" and often serves as an intermediate step for a Doctor of Philosophy degree (Ref 17:4). The statement included most engineering programs in this classification.

The policy statement identifies a second major type of master's degree as being one of a professional nature that gives "instruction in professional affairs and often serves as preparation in those

professions." The Master of Education and the Master's degree in Business Administration are given as examples of this type of professional degree (Ref 17:4). Most of the analysis of programs in this research effort should be viewed as being descriptive in nature, rather than prescriptive. A determination of what requirements should be set for a specific program, entails a consideration of more factors than merely what discipline is involved. Comparisons made in this research between engineering and management programs are not made between two totally dissimilar types of degrees or theses, but an appreciation of the differences that exist between these two areas, and among programs in each area, is necessary when contrasts and comparisons are presented.

Because there is no one answer regarding what a master's degree program should include, or what role the master's thesis can fulfill, further analysis must include consideration for the objectives of a particular master's degree. The master's degree fulfills personal and institutional needs, as well as the needs of society. This study has found no indication that the research function is decreasing in importance in meeting needs in any of these areas.

The Council of Graduate Schools in the United States has stated that master's programs should be designed to allow the student the "opportunity to learn from original sources in the library, from studies conducted in the laboratory, through creative scholarship (whether research or professionally oriented), and through research

or professional practice in the field (Ref 17:7).¹¹ In 1978, 25% of the engineering master's programs require a thesis to meet this requirement and 59% have some thesis option. Management master's degree programs also include the thesis for this function, albeit to a lesser degree, with 3% requiring theses and 41% with optional programs. It is clearly recognized that the master's thesis is not only required in many programs, but the optional use of the thesis is increasing.

Various explanations are possible for the increase in the number of programs that include a thesis option. One factor today is a change in student populations. As the general level of education rises in various segments of the population in the United States, different types of nontraditional students are working in master's programs than previously. More options in type of program, allow greater opportunities to such students.

The thesis credit earned in engineering master's degree programs has remained stable at about 25% of the total credit requirements. In management programs, the thesis credit earned has increased from 16% of the total program requirement in 1970 to 19% in 1978. Even at the current value, the relative thesis value is significantly higher in engineering (25%) programs than in management master's degree programs (19%). This could be caused by a somewhat lesser emphasis on research in management programs, or it could indicate that, if a similar emphasis is placed on research in management programs, it is done in some form other than a thesis.

At the present time management programs have an average total credit requirement that is higher than the average requirement for engineering programs. Currently management master's degree programs require an average total of 34.0 semester hours, while engineering programs currently require 31.1 semester hours. The present figures are much closer than averages from 1970, when management programs averaged 33.4 semester hours and engineering programs averaged 29.4 semester hours.

Both engineering and management master's programs currently have minimum grade point averages of 2.98 on a 4.0 scale. Historical data in the engineering master's programs show this figure to be stable over the last eight years. It is possible that if any change occurs in the required level of scholarship, it will not be immediately apparent in the required grade averages, but rather in inflation or deflation of grades that are awarded for student work.

The small percentage (7.6%) of institutions with engineering master's degree programs that had a foreign language requirement in 1970 has decreased to an extremely small fraction (1.6%) in 1978. The data for management programs show that the requirement for proficiency in a foreign language is no longer present at the master's level.

Finally, the time limits for completing both engineering and management master's degree programs are quite similar. In engineering, the present average time limit is 5.5 calendar years

compared to 5.9 calendar years for management programs. The time requirement in engineering has also been stable since 1970, when the average time limit was 5.4 calendar years.

Non-Thesis Alternatives

Previously reported results show that while the thesis is still a part of most master's programs in some form, many engineering and management programs are designed to offer other alternatives to thesis work.

Engineering Master's Degree Non-Thesis Alternatives. Additional course work is by far the most common (63%) non-thesis alternative being offered today. There are two apparent trends present because of this alternative. The first is that research activity advocated by the Council of Graduate Schools in the United States and the Association of American Universities, among others, as a necessary part of a quality program is included as a part of course offerings. Usually this requirement is stated as some number of term papers, in most programs two or three, that must be accepted as a portion of course work.

The second trend that is developing by substituting course work for a thesis requirement is the deletion of research activity as a part of the master's degree program. Removal of this facet of the master's program is viewed by some persons as a reduction in the quality of the degree that is offered, and by others as a matter of economics and administration.

Some form of independent research or study is the next most common alternative (23%). This type of research is similar to thesis work, but it is usually of a lesser scope and magnitude, or a less formal format than the traditional thesis. Various descriptions for this type of research are used: research report or paper, special project or problem, engineering report, special project or problem, engineering report, special project or problem, design or graduate project, B-plan report, or master's essay. Even though thesis credit requirements vary, the preceding research studies as listed are usually smaller efforts than a master's thesis.

There are also institutions which offer an option that requires a comprehensive examination covering areas presented in course work if a thesis is not written. While this type of program is offered as a non-thesis alternative, it does not offer an alternative research activity. The intent of using comprehensive examinations appears to be an alternative method to ensure the quality or rigor of the program.

Management Master's Degree Non-Thesis Alternatives. Course work is likewise the most common (63%) non-thesis alternative for management master's degree programs. Once again, there seems to be one type of program that includes research activities, such as term papers, as an integral part of the course work, and a second group of programs that have no specific research activity.

The alternatives used in management master's programs are similar to the engineering programs, in that research projects are the second most common alternative (24%). Various terms, such as research report, project or professional papers, field project reports, or essays are all applied to this type of research activity. Scope, breadth and depth of study, and written form differentiate these programs from most theses.

Some alternatives used in both engineering and management programs offer interesting alternatives to the thesis activity. A summary of three of these alternatives is presented in the following discussion.

Internship Programs--Management

Internship programs are presently being used at various institutions, including the University of Houston, Clear Lake City and Southern Methodist University (SMU). Like the master's thesis, the internship program provides a complementary learning experience to classroom study by requiring the student to apply academic concepts to actual business situations. The internship program at SMU offers the same number of credits as the thesis option. The program requires the student to spend a minimum of ten hours with the business each week, although some students spend twenty or more hours per week. Classes are also held to discuss the internship experience, and a final paper detailing the individual student program is required.

(Ref 26:53; 30:39).

This program offers many of the advantages of the master's thesis that are detailed in a following chapter. The program has also proven to be an excellent vehicle for placement of the student upon graduation.

Management Game

Another alternative to the thesis requirement being used in some institutions today is the management game. Dowling University presently uses a type of computer simulation where several teams of players are placed in a situation where decisions must be made that closely parallel those encountered in actual business situations. The students are evaluated by a faculty committee and submit a final report individually. Once again, the student must apply academic concepts to a "real" operational problem. This type of simulation provides a much more structured environment than is found in a thesis effort and is on a smaller scale than a master's thesis. Rather than a thesis alternative, this type of program merely appears to be an adjunct to the classroom experience instead of an alternative research effort.

One final alternative is examined in this chapter. The program is the group design study that is used in the School of Engineering at the Air Force Institute of Technology as a part of the curriculum for a Master of Science degree in Systems Engineering. This program

is of interest because it includes some advantages present in other alternatives and also because various portions of this program are oriented toward management activities and other are oriented toward engineering applications.

Group Design Study

According to Dr. L. E. Wolaver, the Associate Dean for Research at the AFIT School of Engineering, the research function is a very important and necessary part of the product of the Institute. The group design study provides such a product in the form of a feasibility design study that is selected as a class project to study an area of current Air Force interest (Ref 1:41).

The group design study was an integral part of the Systems Engineering program when the degree was established. The study involves seven to twelve students, each performing a research effort comparable in size to a master's thesis as a part of the group design. The Institute advertises to the entire Air Force that this group of students is available. The class spends part of one academic quarter evaluating proposals, selecting a problem, and limiting and defining the necessary research effort. The group then researches the area for the remainder of the nine semester hour effort.

The major advantage to this type of research effort is that problems of a much larger scope than those examined in theses may be studied. The group design study trades off depth of study in

engineering for an exposure to the experience of managing a large real world problem. The group design also allows each student to experience the dynamics of working with others in the research effort, as well as providing an experience in communicating research findings in both oral and written presentations.

The main disadvantage in the group design study is that it is difficult to ensure that each member is contributing effectively to the research activity. The number of methods employed, such as student logs and faculty reviews and evaluations, show that efforts are made to minimize the problem of a few members of the class doing the work for which all members of the group receive credit.

Summary of Alternatives

This research effort has established that there are generally three classifications of alternatives presently being used in engineering and management master's programs. The first substitutes course work and deletes any significant form of research requirement. The second maintains an independent creative research effort, but generally on a smaller scale than the master's thesis. Finally, a third provides a comparable research activity in some form other than the master's thesis, for example the group design study.

VII. Advantages and Disadvantages of the Master's Thesis

In addition to the findings presented in previous chapters, a series of interviews were conducted with different groups of educators in order to examine their attitudes concerning the advantages and disadvantages that are involved in a master's thesis program. One group of educators included the Dean of the School of Engineering, the Associate Dean for Research, and nine professors from various disciplines at the Air Force Institute of Technology. The names of these contributors are listed in Appendix B. The second series of interviews were conducted by Dr. Raymond H. Klug during the August 1978 Academy of Management conference with recognized leaders in the field of management education. The third input into this examination of the advantages and disadvantages of the master's thesis are the ideas from numerous discussions with Dr. Klug. Because of a long standing interest, previous personal research into the area, and extensive experience with master's thesis programs, the considerable insights provided by Dr. Klug are presented as a third and separate part of this chapter.

AFIT Educators

The results from interviews with educators in the AFIT School of Engineering are summarized in this section to refrain from

repetition that would result if opinions of each educator were presented separately. The areas discussed in these interviews centered around the advantages and disadvantages of having a required thesis program. Because this series of interviews for opinions were a secondary effort in this thesis, the selection of the educators was made as a matter of corridor convenience and no attempt was made to sample all faculties. There appeared to be no neutral feelings when this topic was discussed.

Advantages of the Thesis Program. The advantages discussed during these interviews can be generally classified as advantages for the student, the faculty, and the user of the research or the future employer of the thesis student. Most of the educators felt that the greatest number of advantages are experienced by the student.

Graduates from master's programs are often expected to perform creative independent studies upon entering positions in operations research, engineering, or management. The thesis offers a similar unstructured problem that more closely resembles this type of work situation than can be offered in the regular classroom situation. Even if the graduate does not enter such a position, many jobs will require the supervision of such a project. The graduate has an understanding of the complexities and approaches to such a problem even without being associated with any previous work projects because of experience gained during thesis research.

Several abilities are tested and developed within the student during the process of completing a thesis. First, there is a need to identify a subject area, frame objectives, and develop a strategy for the research effort. Second, after the limits to the study have been defined to a manageable size, the student must accomplish as thorough as required. Third, while the student learns how to conduct independent research, guidance and feedback are available from experienced faculty advisors. Fourth, the results from thesis research must be communicated in written and oral presentations. Significant improvements in the ability of the student to communicate are possible. Fifth, the thesis allows specialization in an area that may not be possible in class offerings. Finally, the completion of a thesis can have a positive effect on the self confidence of the student when such a sizable task is completed, which in turn can lead to other successes in future endeavors.

The faculty and the institution granting the degree also receive benefits from a master's thesis program. Graduate students have been referred to as "slave labor" for faculty members conducting research. Sometimes, in order to be useful to the faculty member, the research needs to be at the doctoral rather than the master's level, but there are times when student and faculty research on the master's level can contribute to the publishing efforts of the faculty. Thesis research also allows faculty growth and development that is not possible when conducting classes alone. Possible benefits are

derived by future classes of students when the instructor increases knowledge of areas that were the subjects of thesis research. While material from texts can be taught in many institutions, the particular nature of research conducted in thesis programs can provide a unique identity for the institution and the faculty of that institution.

Finally, and most importantly in the view of a few of the educators interviewed, there are advantages for the sponsors or users of research products as well as employers of graduates from master's degree programs. The end product in the research activities, the thesis, provides needed research that is viewed as a measurable return for the investment in the sponsorship of the program. Other less visible gains are also received by the employers of students doing thesis research when the employer has an opportunity to evaluate the abilities of the individual while the student is solving a work type problem.

In addition to these advantages presented for the student, faculty, and user, there are some disadvantages to consider when evaluating the costs and benefits of a master's thesis program.

Disadvantages of Thesis Programs. Almost all of the educators interviewed felt the biggest disadvantage or cost of the master's thesis program is the large investment of time in the thesis effort. A balance must be made by both the faculty and students between efforts that are directed toward thesis work and those that are directed toward course work. At various points in a program, it is

difficult to avoid letting either one or the other suffer.

Scheduling the thesis into a master's program can also be difficult. The nature and scope of a thesis often makes the research effort lengthy. Even though long lead times are often needed for various portions of thesis research activity, there is also a need to complete classes which provide the necessary tools and knowledge to conduct thesis efforts. Because of this situation, the starting point for a thesis is a compromise between starting the thesis as early in the program as possible to provide for long lead time requirements and starting the thesis late in the program so that the necessary course work can be completed to provide background material.

Another problem arises because not all students have the intelligence or motivation to do thesis work. When a thesis is required, a wide variety of research topics and efforts are accepted to allow for student differences as well as differing quality standards among members of the faculty.

Finally, a mandatory thesis program ignores unique experiences or future goals that certain students have when entering a master's program. In some institutions, like AFIT, students may have extensive work experiences that have already provided many of the rewards that can be gained from a thesis program. This leaves what is viewed as a disproportionately large investment of time and energy for the expected gains.

Views Expressed by Current Members
of the Academy of Management

This research effort is fortunate to include the respected and high level input from several members of the Academy of Management. The interest displayed by these members of the Academy is an indication of the significance and timeliness of this research. The diversity of opinions expressed is also a clear indication that the need to include a master's thesis in a given degree program is not a settled issue. The fact that the views were obtained by Dr. Klug in personal interviews during the busy schedule of events in the August 1978 conference from six past presidents of the Academy of Management, is a credit to the long standing personal relationships Dr. Klug has developed with these educators as well as the enthusiasm and importance Dr. Klug and these educators place on research concerning this topic.

The views of these leading educators varied greatly. One extreme holds the belief that the thesis is the only real learning experience that takes place in the master's degree. All other work can only be considered to be adding to perceptions and knowledge of terms. Opinions at the other extreme show the belief that there is no value to the thesis and the master's thesis is therefore not in general use by quality programs today.

The most prevalent theme from these interviews was the belief that there is a very real need to develop the writing ability of the

student seeking a master's degree. Some felt that the thesis is a proven way to improve the written communication skills of a student, and this alone merits the use of the thesis. One member felt, however, that unless a student planned to continue into graduate education at the doctoral level, additional course work might be of more benefit than practice in writing a dissertation.

Another stated advantage of the thesis is that the student is forced into a world beyond the text book and the classroom. The cultural development associated with the thesis research effort could be as valuable as any other skill developed or research finding presented.

Some of the educators agreed with the advantages of research as a part of the master's program, but felt alternatives such as policy papers, or research on actual business problems in the field have greater benefits than those provided by thesis research. Some of these programs are described in the section of the previous chapter that presents non-thesis alternatives.

Once again, a variety of ideas, opinions, and experiences were voiced. One theme that also is expressed by other sources is that the process of conducting research could be the most important result from the thesis work rather than just the product in the form of research findings presented in written thesis form. This is also one of the many ideas Dr. Klug has expressed concerning the master's thesis.

Individual Views of Dr. Raymond H. Klug,
Professor of Management, AFIT

Although the ideas of Dr. Raymond H. Klug have been an important part of this research, a separate section is used here to present the comments from a series of discussions concerning the master's thesis that have taken place during this research effort. The ideas expressed by Dr. Klug reinforce and amplify some of those voiced by others, while some present new views about the subject. The experience Dr. Klug has received through teaching and administrative positions in conjunction with six universities and being involved as sponsor/advisor on more than thirty graduate theses in his present position as a Professor of Management in the AFIT School of Engineering adds depth and value to the views he has developed through related to graduate education and master's thesis programs. These ideas are summarized in the following portions of this section.

The master's thesis allows the student to learn from the literature, to learn from the thoughts of others, to add to cumulative personal knowledge of both the student and faculty and perhaps add to the knowledge in the field, to profit from past experiences, and to build ahead from these experiences as starting points. The learning and growth experiences which occur while completing a thesis go much beyond this starting point.

While performing thesis research, the student has an opportunity to gain experience gathering material from a field that is in an area

of interest to the student. This provides a chance to study in a real world setting instead of through the sole vicarious learning experience of the classroom. At the completion of thesis work, the student has a visible product that is an example of the proven abilities of the student.

Various skills are developed and opportunities for personal development are encountered during the process of completing a thesis. The student learns to interpret and analyze data, make and defend logical conclusions and decisions, and to present material properly in the form of a written report.

Experiences for growth of a more personal nature are possible. The student can develop poise in meeting and interviewing people and discussing ideas. The student receives constructive criticism during research and reporting activities, and some growth experiences even derive from the temporary frustrations and pitfalls that are inherent in a task with the complexity of a master's thesis. The student also faces the need to exercise self discipline, to follow rules, to experience and cope with pressures, to follow through on a long and sometimes tedious project, and ultimately to experience the feeling of satisfaction for completing a significant task.

Effects of thesis research go beyond those experienced by the student. The thesis is proof of mastery to the institution that grants the master's degree. This proof shows that certain rigorous graduate level academic standards of quality have been required and attained by

a student in the mastery of a subject. The abilities of the student to develop a topic, frame objectives and strategy, and finally to carry the research of the topic to a logical completion have been demonstrated. Such a thesis program also helps to maintain the reputation of an institution as one with high standards for quality.

Frequently, there is also a payback to the user of the products from these graduate activities. In the example of AFIT, the United States Air Force and ultimately the tax payers who fund the Institute, receive a payback in the form of research that most often addresses actual Air Force problems. Beyond this paper product, embodied by the thesis itself, the real lasting product, so often emphasized by Dr. Klug, is the student enriched by the benefits detailed earlier, becomes of long term benefit to the Air Force and to the nation.

Finally, the faculty receives benefits of both a personal and professional nature from the research effort. On the personal level, the real reward to a teacher comes from the opportunity to get to know, help, associate with, and watch a student grow. Lasting friendships can develop during thesis research that will be mutually beneficial and meaningful in years to come. In a matter of professional gain, the faculty also has an added opportunity to upgrade the information base from which future teaching and research activities can be conducted. The dealings with student research activity is an excellent way to stay in tune with current trends and developments in a field.

All of the benefits to the various involved parties must be compared to the tremendous investments of time, effort, and at times, capital outlay that are the costs for such research activities as the master's theses.

Major changes in the future availability of faculty time, varying student interests, new trade-off opportunities, and the economies of changing such programs must continue to be reassessed within differing institutional settings, enrollments, goals, and standards to meet changing customer requirements. Thus, the subject of requiring a thesis as proof of mastery must remain an open and flexible issue to keep abreast of, and to lead in, progressive change as required. The master's thesis at AFIT still offers a proven and useful approach to customer satisfaction and student development.

This concludes the final portion of the comments from various educators and experts. The following section presents summarizing and concluding remarks about these discussions.

Final Comments

The majority of the educators voiced opinions that the benefits of thesis research are extremely important, to the extent that any quality program should include such work. Others felt that the research activity was definitely important, but the form of such activity need not be a thesis. Lastly, a minority felt the thesis was of little value unless the student planned future research at the

doctoral level.

The idea that the research activity need be called a thesis is not always held to be sacred. Some educators felt that any research activity of the same size and scope as a thesis was adequate. It is also interesting to note that many of the AFIT educators said acceptable limits for a thesis included a wide range of activities.

It appears that some have emotional feelings about the thesis that go beyond the idea of evaluating the costs and benefits of the program. In the extreme these could almost be viewed as rites of initiation instead of proof of mastery. Because of this, changes in present thesis programs will not be acceptable merely because similar benefits may be realized from an alternate program. Alternatives must be well articulated and have clear advantages for those deciding on the change. There are some programs that have changed thesis research requirements for other factors.

One educator proposed that various companies and organizations no longer attempt to evaluate the abilities or potential of a person, but rather establish a requirement for some academic degree, such as a master's. This forces the institution that offers such degrees to set acceptable standards for a degree that signifies some given level of ability. If the degree becomes the primary goal of the exercise, rather than any learning experience, the market of institutions that are willing to provide degrees for minimum efforts will boom. The educator concluded that decreases in the quality of

some master's programs is caused by organizations that require the master's degree, but do not utilize the potential gains from the educational experience the student could have provided.

It appears from the views of most educators as well as professional groups such as the Council of Graduate Schools in the United States that an independent creative research learning experience is necessary in quality master's programs. The thesis remains an acceptable form for this research activity in many institutions, but other forms of research are also being used.

These ideas complete the research activity involved with fulfilling the objectives of this study. During this research, there were two factors that were present in varying degrees during almost all discussions concerning the use of the master's thesis. One of these factors was the resistance to change that maintains that quality can only be maintained by maintaining traditional requirements and standards. Some experts describe the master's degree as weakened in recent years due to the wide diversity of programs that presently exist and the ever-increasing stress of accommodating the number of people seeking a master's degree (Ref 3:186-187). Others have viewed the removal of the language and thesis requirements from some master's programs and other proposed changes as lowering the quality of scholarship and weakening the degree (Ref 15:445).

The second force is one that calls for change. This idea is illustrated by part of a resolution adopted in 1969 by the Conference on Predoctoral Education.

The intense research experience characteristic of programs which lead to the degree of Doctor of Philosophy is superb preparation for those pursuing careers in basic research. It is increasingly clear, however, that society also needs, and graduate students are seeking, alternative forms of graduate education. New graduate programs must be devised in response to the changing body of knowledge and to our need for persons educated to cope with urgent, newly emerging problems (Ref 18:1).

Neither of these factors is new. The issues that are behind these two views have been faced during the entire history of graduate education in the United States. The following is a list of issues that were discussed when some early programs were established.

1. Why put scarce resources into new programs when present ones could be improved with those resources?
2. The expenses of education cannot be much increased (a sentiment expressed by the president of Harvard College in 1816).
3. Will there be employment for those with a master's degree?
4. Is graduate education to be viewed primarily as academic or professional in nature?
5. What action should be taken to resolve the conflict that arises between influences on educational policies from within the academic community and from those outside that are sometimes called the "needs of the times?" (Ref 3:7-8)

These historical factors are faced when examining the master's degree or master's thesis today. The history, present position, and future of the master's degree has, and will be shaped by these issues that have, as Berelson stated, shown "an impressive historical vitality (Ref 3:9)."

VIII. Summary, Conclusions, and Recommendations

The first seven chapters of this thesis have presented the problem that is addressed in this study, the objectives of this research, the methodology used to examine this area, and the findings from this research activity. The purpose of this chapter is to summarize these research activities and findings, present conclusions, and propose recommendations for future actions and study.

Summary

Even though approximately 300,000 master's degrees will be earned during the 1977-1978 academic year, there seems to be a confusion about what elements are necessary to be included in a master's degree. The requirement for a completed master's thesis is one such area of confusion. This research has been conducted to more closely examine master's theses and degree programs in engineering and management.

Several research objectives were developed for this study. The primary objective for this study was to identify trends in the requirement for completing a thesis in management and engineering master's degree programs. The secondary objectives for this research included the following:

1. Identify trends in non-thesis alternatives presently in use in management and engineering master's programs.

2. Identify possible thesis alternatives that could be used in the future.
3. Identify advantages and disadvantages of completing a master's thesis.

Details follow regarding the three part methodology used in gathering data for this study. The first portion of this data collection consisted of a literature review that gathered background information and provided insights into historical and current forces and factors affecting the requirement for having master's programs and master's theses today. The second portion of this effort involved an extensive review of engineering and management master's degree programs to study current trends.

Engineering master's degree programs were examined by analyzing the 1970 programs in 176 institutions and the 1978 programs from 190 institutions using summaries compiled in Engineering Education. Similar and comparable studies were conducted for management programs. The information compiled in Peterson's Annual Guides to Graduate Studies was used to review 136 programs from 1969 and 123 programs from 1977 for thesis requirements and trend identification and comparison with programs of relatively the same time frame.

In order to gain a more complete understanding of current management programs, a parallel study was conducted that included the review of 80 management program summaries compiled by the Educational Testing Service of 1970 program offerings and a total of 202 college catalogs for the current academic year, 1977-1978. The

third portion of this research effort included interviews conducted with selected groups of educators. Chapter II also contains the scope and limitations to the research that was conducted for this thesis.

By way of background information the first master's degrees of record, were awarded in France as early as the twelfth century, but it was not until 1876 at Johns Hopkins University that the first program was established in the United States to conduct graduate work that was recognized with the granting of a master's degree as it is known today. While the master's thesis was often included in these early programs, the inclusion of such work was debated. Historical factors often play a role in discussions conducted even today concerning the thesis requirement.

As a result of this study, present findings from the program review portion of this research show that 25.4% of engineering and 2.6% of management master's degree programs require a thesis. The percentage that have optional thesis programs is 59.1% for the engineering programs and 41.0% for the management programs. Management master's degree programs currently require an average of 34.0 semester hours and engineering master's degree master's programs require an average of 31.1 semester hours. The current mean average of credit requirements for the master's thesis are 7.33 semester hours for engineering theses and 6.36 semester hours for management theses, respectively. Minimum grade point average

requirements are set at the "B" level for both types of master's degree programs. The requirement for a proficiency in a foreign language is included in 1.6% of the engineering master's degree programs and in none of the management programs. Time limits for completing master's degree work are similar between the two types of programs, with a time limit of 5.5 calendar years for engineering programs and 5.9 calendar years for management programs.

Many institutions presently offer alternatives to master's thesis research. The most common alternative to the thesis is the substitution of an equivalent or greater number of credit hours of course work. This alternative either requires research activities in some form such as term papers, or deletes the research requirement from master's degree work. Substitute research activities of somewhat lesser magnitude, such as individual design projects, essays, or policy papers are the second most common alternative to the thesis option. Finally, alternatives such as internship programs or group design studies provide comparable and similar research alternatives to the thesis.

Some personal views expressed during a series of interviews with educators concerning the advantages and disadvantages of a thesis requirement are summarized from AFIT educators, members of the Academy of Management, and Dr. Raymond H. Klug. The advantages discussed during these interviews centered around benefits to the student, the faculty, and the user of the research findings

as follows:

1. The student experiences advantages from master's thesis research that include opportunities and learning experiences away from the classroom.
2. Faculty members benefit from master's thesis research by increasing personal knowledge that will aid in future research and classroom teaching activities, and by obtaining research findings which may be helpful in preparing works for publication.
3. The user of the research findings receives the benefits of the findings and sometimes has an opportunity to evaluate future employees by observing thesis students during research activities. The main disadvantage identified was the high cost of student and faculty time, and at times, the high capital outlay required to conduct research in areas such as engineering.

The conclusions that are reached from this research effort are summarized and presented in the following section.

Conclusions

Findings from this research effort suggest the following conclusions concerning the use of the master's thesis in engineering and management master's degree programs.

1. The master's thesis continues to be used as an integral part of some engineering master's degree programs today.

The master's thesis is mandatory in 25.4% and is optional in 59.1% of engineering programs in the

United States today.

2. It is concluded that the master's thesis is no longer considered a necessary and mandatory part of most engineering programs.

The percentage of engineering programs that have a mandatory master's thesis has decreased from 40.8% in 1970 to 25.4% in 1978.

3. Many institutions continue to use the master's thesis in management master's degree programs.

The master's thesis is mandatory in 2.6% and is optional in 41% of management programs in the United States today.

4. It is concluded that the master's thesis is no longer considered a necessary and mandatory part of most management programs.

The percentage of management programs that have a mandatory master's thesis has decreased from 9.4% in 1970 to 2.6% in 1978.

5. It is concluded that thesis research plays a less significant role in management master's degree programs than in engineering master's degree programs.

Currently, the average thesis requirement is 6.4 semester hours in management master's degree programs that require an average of 34.0 total semester hours of credit. This compares to the 7.3 semester hour average thesis requirement that is present today in engineering master's degree programs which require an average of 31.1 total semester hours of credit. The master's thesis in management programs represents a smaller requirement in absolute terms, and to an even greater extent, in relative terms when compared to the total program credit requirements.

The trends and differences illustrated in the conclusions in this section indicate that there is no single answer to what requirements

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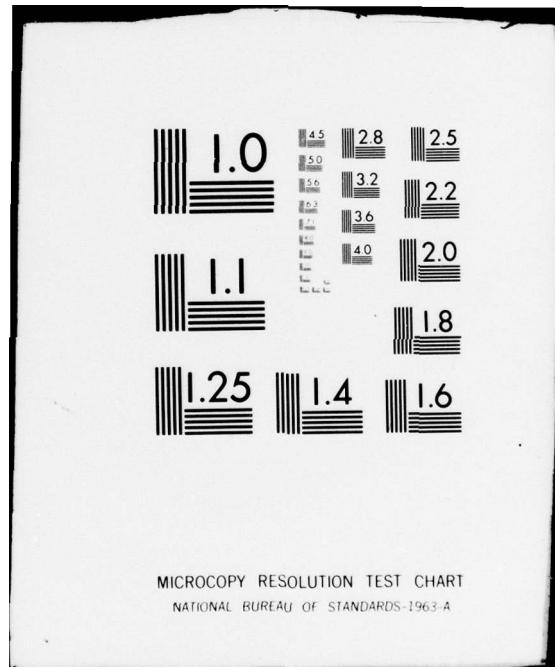
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should be established for all master's degrees, nor can such an answer be addressed without considering a variety of dynamic forces and factors. The final portion of this thesis presents recommendations for future actions and study that have resulted from this research effort.

Recommendations

It is recommended that:

1. A more detailed study of institutions be conducted to find if the number of students doing various types of thesis and non-thesis study has actually changed in proportion to the number of institutions that have changed requirements as indicated by this research.
2. Further research be conducted to study the advantages and disadvantages of thesis work from views of past graduates of master's degree programs and from sponsors or users of thesis research to more completely analyze the perceived costs and visible benefits of theses work from those two viewpoints.
3. The mandatory thesis requirement in the Systems Management curriculum and some other engineering programs in the AFIT School of Engineering be examined to determine if current trends toward optional thesis programs could present other research alternatives that would better recognize the special experience of some AFIT students and also be of greater benefit to the United States Air Force.

These recommendations conclude the presentation and reporting of this research effort. The help and guidance of Dr. Raymond H. Klug and the manuscript reading by Dr. Joseph P. Cain are appreciated. A topic has been developed that not only allowed this writer the opportunity to gain insights into research activities and an

appreciation for the learning experience associated with a master's thesis effort, but also to increase personal knowledge of a timely and relevant subject. It is hoped that the research presented in this thesis will be informative to others in the future.

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Appendix A

Institutions from AACSB Included in 1978 Management Program Review

1. Adelphi University*
2. The University of Alabama
3. Alabama A&M University
4. Albany State College
5. Alcorn State University
6. Andrews University
7. University of Arizona*
8. University of Arkansas*
9. University of Arkansas at Monticello
10. Arkansas Tech University
11. Atlanta University
12. Augusta College
13. Babson College*
14. University of Baltimore
15. Baylor University*
16. Bloomsburg State College
17. Boston College*
18. Bowling Green State University
19. University of Bridgeport*
20. Bryant College*
21. University of California, Berkeley
22. University of California, Los Angeles*
23. California Polytechnic State University, San Luis Obispo
24. California State College, Dominguez Hills
25. California State College, Stanislaus
26. California State University, Fullerton
27. California State University, Long Beach
28. California State University, Sacramento
29. Canisius College*
30. Capital University
31. Case Western Reserve University*
32. University of Central Arkansas

*Institutions included in 1970 Management Program Review.

33. Central Missouri State University
34. Chaminade College of Honolulu
35. Clarion State College
36. University of Colorado*
37. Columbia University*
38. University of Connecticut*
39. Creighton University
40. Dartmouth College
41. University of Delaware*
42. DePauw University*
43. Dowling College
44. Drexel University*
45. Duke University*
46. East Carolina University*
47. East Texas State University
48. Eastern Kentucky University
49. Eastern New Mexico University
50. Elmhurst College
51. University of Evansville
52. Fayetteville State University
53. Ferris State College
54. Florida A&M University
55. Florida State University
56. Fordham University
57. Franklin University
58. Gallaudet College
59. George Mason University
60. University of Georgia*
61. Georgia Southern College
62. Glassboro State College
63. Gonzaga University
64. Grambling State University
65. Hampton Institute
66. Harding College
67. Harvard University*
68. Henderson State College
69. University of Houston at Clear Lake City
70. Humboldt State University
71. University of Illinois at Chicago Circle
72. Illinois Institute of Technology*
73. Indiana State University*
74. University of Iowa*
75. John Carroll University
76. University of Kansas*

77. Kean College of New Jersey	98. University of Missouri-Columbia*
78. Kent State University*	99. University of Missouri-St. Louis*
79. Kentucky State University	
80. LaSalle College	100. Monmouth College
81. Long Island University	101. Montclair State College
82. Louisiana State University*	102. Moorhead State University
83. Louisiana Tech University	103. University of Nebraska-Lincoln*
84. Loyola College*	104. University of Nevada, Las Vegas*
85. Madison College	105. University of New Hampshire*
86. Manhattan College	106. University of New Haven*
87. Marquette University*	107. New Mexico State University*
88. Marshall University*	108. New York University*
89. University of Massachusetts-Boston*	109. Nichols College
90. McNeese State University	110. North Adams State College
91. Mercy College	111. The University of North Carolina at Charlotte*
92. Metropolitan State College	112. University of North Carolina at Wilmington
93. University of Michigan-Dearborn	113. The University of North Dakota
94. Michigan State University*	114. University of North Florida
95. Middle Tennessee State University	115. Northeast Louisiana University*
96. University of Minnesota, Duluth*	116. Northern Arizona University
97. Mississippi College	117. Northern Illinois University

118. Northern Kentucky University

119. Northern State College

120. Northwestern State University of Louisiana*

121. University of Notre Dame

122. Ohio Northern University

123. Ohio University*

124. Oklahoma City University*

125. Old Dominion University*

126. Oregon State University*

127. University of the Pacific

128. Pan American University

129. The Pennsylvania State University*

130. Pepperdine University

131. University of Portland

132. Prairie View A&M University

133. Providence College

134. Purdue University*

135. Quinnipiac College

136. Rensselaer Polytechnic Institute*

137. Rider College*

138. Robert Morris College

139. Rochester Institute of Technology*

140. Rutgers University, The State University of New Jersey*

141. Saint Ambrose College

142. St. Bonaventure University

143. Saint Francis College

144. Saint Joseph's College

145. Saint Mary's College

146. St. Mary's University*

147. Samford University*

148. San Diego State University*

149. San Francisco State University

150. Sangamon State University

151. Shepherd College

152. Slippery Rock State College

153. University of South Carolina*

154. University of South Dakota*

155. Southeast Missouri State University

156. Southeastern Massachusetts University

157. University of Southern California*

158. Southern Illinois University at Carbondale*

159. Southern Methodist University*

160. Southern Oregon State College

161. Southwest State University

162. University of Southwestern Louisiana

163. State University of New York at Albany*

164. State University of New York at Buffalo*

165. Stetson University

166. Temple University*

167. University of Tennessee, Knoxville*

168. University of Tennessee at Nashville

169. Tennessee Technological University

170. The University of Texas at El Paso

171. Texas A&I University

172. Texas Christian University*

173. Texas Tech University

174. Trenton State College

175. Troy State University

176. University of Tulsa*

177. United States International University*

178. Utah State University*

179. Valparaiso University

180. University of Virginia*

181. Virginia Commonwealth University

182. Virginia State College

183. Wake Forest University

184. Washburn University of Topeka

185. Washington and Lee University

186. Washington University*

187. Wayne State University*

188. West Chester State College

189. West Georgia College

190. West Texas State University

191. Western Carolina University

192. Western Illinois University

193. Western New England College

194. Western Washington State College

195. Wichita State University*

196. College of William and Mary*

197. Winthrop College

198. University of Wisconsin-LaCrosse

199. University of Wisconsin-
Oshkosh
200. University of Wisconsin-
Whitewater
201. University of Wyoming*
202. Youngstown State University

Appendix B

AFIT Educators Interviewed

T. S. Przemieniecki, B.S., D.I.C., Ph.D., C.Eng., P.E., Dean of the School of Engineering

Lynn E. Wolaver, B.S., M.S., Ph.D., Associate Dean for Research

Faculty Members:

Joseph P. Cain, B.B.A., M.A., Ph.D.

Robert A. Calico, Jr., B.S., M.S., Ph.D.

Ernest A. Dorko, B.S., M.S., Ph.D.

Major Edward J. Dunne, Jr., B.S., M.S., Ph.D., P.E.

William C. Elrod, B.M.E., M.M.E., Ph.D., P.E.

Lieutenant Colonel Thomas R. Manley, B.S., M.S., Ph.D.

Peter J. Torvik, B.S., M.S., Ph.D.

Norman K. Womer, A.B., Ph.D.

Harold E. Wright, B.M.E., M.S., Ph.D., P.E.

Vita

James Lawrence Simmons was born on 29 March 1950 at Offutt Air Force Base, Nebraska. Following graduation from high school at Ellsworth Air Force Base, South Dakota, he entered the United States Air Force Academy. In June 1972, he graduated with a degree of Bachelor of Science in Aeronautical Engineering and was commissioned as an officer in the United States Air Force. Following crew training at Vandenberg Air Force Base, he was stationed at F. E. Warren Air Force Base, Wyoming, where he served as a missile launch officer. During this tour, he served as deputy commander and commander on missile crews in the Minuteman weapon system, as well as a Standardization/Evaluation evaluator. He received two Air Force Commendation medals during this tour. In April 1976, he was assigned to Vandenberg Air Force Base, California as an instructor in the Minuteman Modernized/Command Data Buffer weapon system. He remained at Vandenberg until his assignment to the School of Engineering, Air Force Institute of Technology, in June 1977.

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Master's thesis Engineering master's degree Management master's degree		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Today there is considerable disagreement about what educational experience should be required for the master's degree. This research was conducted to examine trends in the requirement for thesis work in engineering and management master's degree programs. Trends in other areas such as thesis credit, master's degree total requirements, minimum grade point averages, requirements for proficiency in a foreign language, and		

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time limits to completing master's work were also examined. Since 1970, the number of institutions with mandatory theses programs has decreased in both engineering and management master's degree programs while the number with optional theses programs has increased. Engineering programs have higher average thesis credit requirements than management programs, but management master's degree programs have higher average total degree credit requirements. Another portion of this study involved an examination of non-thesis alternatives. Theses alternatives can be classified as programs that delete the research requirement, programs that conduct research on a smaller scale than the thesis with requirements like term papers or independent studies, and alternatives such as internship programs or group design studies that provide a research experience of the relatively same scale as the master's thesis, but with a different format. Finally, a review and examination regarding the current personal advantages and disadvantages of the master's thesis was accomplished through interviews with selected groups of educators. Advantages for the student, faculty, institution, and users of research findings were identified. Disadvantages cited involved high cost for faculty and student time and research facilities.

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